

VEHICLE SEAT HEADREST ADJUSTMENT APPARATUS

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of U.S. Provisional Application No. 60/537,480, filed on January 16, 2004. The disclosure of the above application is incorporated herein by reference.

FIELD OF THE INVENTION

[0002] The present invention relates to seat assemblies, and more particularly, to an improved headrest assembly for use with a seat assembly.

BACKGROUND OF THE INVENTION

[0003] In vehicle design, occupant safety is becoming increasingly important. To that end, vehicle safety systems and vehicle structure play a significant role. As a general proposition, when a moving vehicle is abruptly stopped (i.e., from contact with a stationary object or another vehicle), the forward momentum and associated forces are transferred to the vehicle occupants by way of vehicle structure and associated components. To minimize the effects of such forces on vehicle occupants, vehicle safety systems work in conjunction with energy management devices to transfer energy generated by the vehicle impact generally to the structure of the vehicle and away from the vehicle occupants.

[0004] Safety systems commonly work in conjunction with vehicle structure to transfer impact forces and divert the associated energy away from the vehicle occupants and into the vehicle structure. Modern vehicle safety systems commonly include a variety of energy management devices such as seatbelts and airbags to help protect a passenger in the event of an impact or accident. Such systems are typically designed to work together with sensors and other structural elements such as door beams, side sill sections, and body panels to improve overall vehicle safety and provide the best possible protection for vehicle occupants. More particularly, such systems act to gradually decelerate the occupants with the vehicle structure to dissipate the forces away from the occupants and into the vehicle structure.

[0005] Such impact forces are commonly absorbed by the vehicle structure through deformation of steel and other structural components. In an effort to effectively transmit impact forces to the vehicle structure, vehicle safety systems are implemented to safely transmit the force from a moving occupant (i.e. an occupant moving forward relative to a vehicle structure) to the vehicle structure via an energy management device such as a seatbelt or an airbag. More particularly, the forces associated with an occupant moving relative to the vehicle are safely and controllably transmitted to the vehicle structure via a seatbelt or an airbag such that the structure, as opposed to the occupant, can manage the energy.

[0006] Energy management devices, such as airbags and seatbelts, are commonly designed to be used in conjunction with one another to transfer

impact forces to the associated vehicle structure. Airbags are generally operable to transmit a force received by a moving occupant to the vehicle structure, while seatbelts are operable to transmit similar forces to the vehicle structure via a vehicle floor pan or vehicle seat, depending on the particular application. As can be appreciated, such vehicle seats are operable to receive the impact force from one of, or both, the airbag and seatbelt to dissipate energy safely to the vehicle structure, thereby protecting the vehicle occupants.

[0007] In addition to the aforementioned safety systems, vehicle seats also play a significant role in occupant protection. As can be appreciated, vehicle seats are commonly designed to work with safety systems and energy management devices to divert impact forces into the vehicle structure and away from vehicle occupants.

[0008] Conventional seat assemblies commonly include a seatback pivotably supported by a seat bottom and a recliner mechanism. The recliner mechanism is disposed between the seatback and the seat bottom and is operable to selectively position the seatback relative to the seat bottom. In this manner, the ability of the seatback to absorb and transfer forces to a vehicle structure includes at least two components. First, the overall strength of the seatback structure must be of sufficient rigidity to receive a force from an occupant and transfer the associated force to the vehicle structure, and second, the recliner mechanism must be able to transmit such forces from the seatback to the seat bottom and associated vehicle structure. In this regard, interaction

between the occupant and the seatback plays a role in energy management during an impact event.

[0009] To ensure adequate engagement with a vehicle occupant, conventional vehicle seats commonly include a headrest assembly. Typical headrest assemblies are disposed at an opposite end of the seatback from the recliner mechanism and are operable to receive an occupant's head during normal driving conditions as well as during an impact event. Such headrest assemblies typically provide the occupant with the ability to adjust the position of the headrest relative to the seatback so as to provide each individual occupant with a desirable and comfortable headrest position. As can be appreciated, such an adjustment provides the occupant with the ability to adjust the headrest so as to increase the comfort of the seat assembly under normal driving conditions both axially (i.e., up and down) and in a fore-aft direction. In addition, the adjustment provides the occupant with the ability to adjust the headrest in response to rotation or reclining of the seatback relative to the seat bottom.

[0010] Forward adjustment of the headrest upon rearward recline of the seatback relative to the seat bottom helps to ensure that the occupant's head is in close proximity to the headrest at all times. Specifically, under normal driving conditions, positioning of the headrest in such a fashion helps support the occupant's head, thereby providing the occupant with increased comfort. Under an impact event, positioning the headrest in proximity to the occupant's head encourages the occupant to engage the headrest shortly after the initial impact, thereby quickly and efficiently transmitting the impact force from the occupant

into the vehicle seat. As previously discussed, such energy management allows the seat assembly and associated vehicle structure to dissipate the impact force and protect the occupant.

SUMMARY OF THE INVENTION

[0011] A headrest assembly is provided and includes a first housing rotatably supporting a second housing, whereby the second housing is movable between a fully upright position and a fully dumped position. In addition, an adjustment mechanism is provided and includes a cross-member fixedly attached to the first housing and a lock member operable between a locked position and an unlocked position. The lock member engages the cross-member in the locked position and disengages the cross-member in the unlocked position. A lever is rotatably attached to the cross-member and is operable to selectively unlock the lock member and permit rotation of the second housing. Rotation of the second housing relative to the first housing allows the second housing to be rotated between the fully upright position and the fully dumped position.

[0012] Further areas of applicability of the present invention will become apparent from the detailed description provided hereinafter. It should be understood that the detailed description and specific examples, while indicating the preferred embodiment of the invention, are intended for purposes of illustration only and are not intended to limit the scope of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] The present invention will become more fully understood from the detailed description and the accompanying drawings, wherein:

[0014] FIG. 1 is a perspective view of a headrest assembly in accordance with the principals of the present invention;

[0015] FIG. 2A is an exploded view of the headrest assembly of FIG. 1;

[0016] FIG. 2B is a is a more detailed exploded view of particular components of FIG. 2A;

[0017] FIG. 3 is a perspective view of the headrest assembly of FIG. 1 shown in a first locked position;

[0018] FIG. 4 is a cross-sectional view of the headrest assembly of FIG. 3 taken along line A-A and shown in a locked position;

[0019] FIG. 5 is a cross-sectional view of the headrest assembly of FIG. 3 taken along line A-A and shown in an unlocked position;

[0020] FIG. 6 is a cross-sectional view of the headrest assembly of FIG. 3 taken along line A-A and shown in a locked and dumped position;

[0021] FIG. 7 is a side view of the seat assembly of FIG. 6 in an upright position; and

[0022] FIG. 8 is a side view of the seat assembly of FIG. 6 in a first reclined position.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0023] The following description of the preferred embodiment(s) is merely exemplary in nature and is in no way intended to limit the invention, its application, or uses.

[0024] With reference to the Figures, a headrest assembly 10 is provided and includes an upper housing 12, a lower housing 14, and a lock assembly 16. The upper housing 12 is rotatably supported by the lower housing 14 and is selectively held in a plurality of positions relative to the lower housing 14 by the lock assembly 16, as will be described further below.

[0025] With particular reference to FIGS. 2A and 2B, the upper housing 12 is shown to include a main body 18 and a first and second flange 20, 22 integrally formed therewith. The first flange 20 includes an attachment aperture 26 and a spring post aperture 28, while the second flange 22 similarly includes an attachment aperture 30 and a spring post aperture 32. As best shown in FIG. 2A, the main body 18 extends between the first and second flanges 20, 22 such that a space 34 is formed therebetween.

[0026] The lower housing 14 rotatably supports the upper housing 12 and includes a main body 36, a first and second flange 38, 40, and an extension 42. The first and second flanges 38, 40 are integrally formed with the lower housing 14 and each include an attachment aperture 44, 45, respectively. Attachment aperture 45 is a generally circular aperture and is co-aligned with attachment aperture 30 of flange 22 while attachment aperture 44 is a keyed aperture and is generally co-aligned with attachment aperture 26 of flange 20.

The extension 42 is similarly integrally formed with the lower housing 14 and includes a slot 46 and a plurality of attachment apertures 48. In addition, an interstitial space 50 is formed generally between the main body 36, first and second flanges 38, 40, and extension 42 for interaction with the upper housing 12, as will be discussed further below.

[0027] The lock assembly 16 is disposed generally within the spaces 24, 50 of the upper and lower housings 12, 14, and includes a cross-member 52, a lock lever 54, and a lock spring 56. The cross-member 52 is a generally elongate cylindrical member extending within interior space 24 of the upper housing 12 generally between the first and second flanges 20, 22 and includes a pair of flats 53 and a recess 55. The cross-member 52 is rotatably received by attachment apertures 26, 30 of flanges 20, 22 and is fixably received by attachment apertures 44, 45 of the lower housing 14. In this manner, the upper housing 12 rotates about the cross-member 52 relative to the lower housing 14 while the cross-member 52 is restricted from rotating relative to the lower housing 14 due to the interaction between flats 53 and attachment aperture 44. In addition, the cross-member 52 includes a spring seat 58 at a first end and a recess 60 at a second end, as best shown in FIGS. 2A and 2B. The spring seat 58 extends from an outer surface of the first flange 38 and is operable to receive a coil spring 62. The recess 60 extends from an outer surface of the second flange 40 and is operable to receive a lock washer 64 to secure the cross-member 52 to the lower housing 14.

[0028] The lock lever 54 serves to toggle the lock assembly 16 between a locked condition and an unlocked condition, whereby in the locked condition the upper housing 12 is restricted from rotation relative to the lower housing 14 and in the unlocked condition the upper housing 12 is permitted to rotate relative to the lower housing 14. The lock lever 54 includes a main body 66, an attachment aperture 68, a stop 70, and an extension 72. The attachment aperture 28 is formed through the main body 66 and rotatably receives the cross-member 52 such that the lock lever 54 rotates about the cross-member 52 relative to the lower housing 14. The stop 70 is integrally formed with the main body 66 and extends therefrom for interaction with the lower housing 14. The extension 72 is similarly integrally formed with the main body 66 of the lock lever 54 and includes a spring post 74 extending therefrom. In addition, a slot 73 is formed in the main body 66 and is operable to provide clearance between the lock lever 54 and the upper housing 12 for interaction with the lock spring 56, as will be described further below.

[0029] A spring 76 is provided to bias the lock lever 54 into the lock or engaged position. The spring 76 includes a circular main body 78 and a first and second leg 79, 80 and is rotatably supported by the cross-member 52. The circular main body of the spring 76 is matingly received by the generally circular outer diameter of the cross-member 52 and includes a collar 77 therebetween. The collar 77 is operable to allow the circular main body 78 to expand and contract without constricting the outer diameter of the cross-member 52. In other

words, the collar 77 is operable to allow the spring 76 to rotate relative to the cross-member 52 whether the spring 76 is in a relaxed or constricted state.

[0030] The first leg 79 engages the spring post 74 of the lock lever 54 while the second leg 80 engages the main body 18 of the upper housing 12 to rotatably bias the lock lever 54 in the clockwise (CW) direction relative to the view shown in FIG. 4. In addition, a lock washer 84 is matingly received by the recess 55 of the cross-member 52 to maintain the spring 76 in engagement with the lock lever 54, as best shown in FIG. 3.

[0031] The lock spring 56 is operable to lock the upper housing 14 relative to the lower housing 14 and includes a generally coiled main body 86 and a first and second leg 87, 88 extending therefrom. The first leg 87 is fixably attached to the main body 66 of the lock lever 54 at the slot 73 such that as the lock lever 54 rotates, the coil 86 of the lock spring 56 will concurrently rotate therewith. The second leg 88 is fixably received by a spring post 90 of the upper housing 12 such that the second leg 88 is fixed relative to the upper housing 12, as best shown in FIG. 3. The spring post 90 is fixedly received through attachment aperture 32 of the second flange 22 and serves to fix the leg 88 relative to the upper housing 12 such that the leg 88 is restricted from moving relative thereto. Specifically, the spring post 90 includes a slot 91 operable to matingly receive the second leg 88 of the lock spring 56 to restrict rotation of the second leg 88 relative to the upper housing 12.

[0032] With particular reference to FIG. 3, the circular main body 86 of the lock spring 56 is shown to matingly receive the generally circular outer

diameter of the cross-member 52. It should be noted that in a relaxed state, such as prior to installation to the cross-member 52, the circular main body 86 of the lock spring 56 includes an inner diameter which is slightly smaller than an outer diameter of the cross-member 52. In this manner, in order for the lock spring 56 to be assembled to the cross-member 52, a force must be applied to the legs 87, 88 such that the coils of the circular main body 86 unwind or expand enough to allow the circular cross-member 52 to be inserted therein. As can be appreciated such a force, when released, causes the circular main body 86 of the lock spring 56 to contract once again, thereby causing the circular main body 86 to grasp or grab the outer diameter of the cross-member 52.

[0033] Once the lock spring 56 grasps the outer diameter of the cross-member 52, the lock spring 56 is fixed to the cross-member 52 and is restricted from rotating relative to the cross-member 52. In such a condition, the upper housing 12 is restricted from rotating relative to the lower housing 14 due to the interaction between the leg 88 of the lock spring 56 and the spring post 90 of the upper housing 12. Specifically, because the spring post 90 is fixably attached to flange 22 of the upper housing 12 via spring aperture 32, the leg 88 is effectively fixed to the upper housing 12. When the circular main body 86 grasps the outer diameter of the cross-member 52, the spring 56 is restricted from rotating relative to the cross-member 52, as previously discussed. In this regard, because the leg 88 is fixably attached to the upper housing 12 via spring post 90, and because the circular main body 86 grasps the cross-member 52, the upper housing 12 is

restricted from rotation relative to the lower housing 14, as will be discussed in further detail below.

[0034] The coil spring 62 is disposed on an outer surface of the lower housing 14, and serves to bias the upper housing 12 in the counter clockwise direction relative to the view shown in FIG. 4. The coil spring 62 includes a central flat 92 and an outwardly extending arm 94. The central flat 92 is matingly received by the spring seat 58 of the cross-member 52 while the outwardly extending arm engages a spring post 96. The spring post 96 is fixably attached to the upper housing 12 at spring aperture 28. In this manner, the coil spring 62 serves to bias the upper housing 12 in the counter clockwise direction relative to the view shown in FIG. 4, and is operable to bias the upper housing 12 into a fully upright position, as will be discussed further below.

[0035] With particular reference to FIGS. 7 and 8, the headrest assembly 10 is shown incorporated into a seat assembly 100. The seat assembly 100 includes a seat bottom 102, a seatback 104, and recliner mechanism 106. The seatback 104 is rotatably supported by the seat bottom 102 and includes the recliner mechanism 106 disposed therebetween. The recliner mechanism 106 is operable to selectively permit and restrict rotation of the seatback 104 relative to the seat bottom 102, as will be discussed further below.

[0036] The headrest assembly 10 is fixably attached to the seatback 104 at the lower housing 14. More particularly, the apertures 48 of the extension 42 are operable to fixedly attach the headrest assembly 10 to the seatback 104

generally at the lower housing 14, such that the lower housing 14 is restricted from moving relative to the seatback 104. In addition, the headrest assembly 10 includes an outer plate 107 for interaction with a padded or exterior support structure 109 of the seat assembly 100, as best shown in FIG. 7. The outer plate 107 is operable to conceal the lock assembly 16 and upper and lower housings 12, 14 to provide a consistent surface for the padded structure 109 to engage.

[0037] The lock assembly 16 is in mechanical communication with the recliner mechanism 106 via a first cable 108. The first cable 108 is fixably attached to the recliner mechanism 106 at a first end and to the lock lever 54 at a second end. Specifically, the second end of the cable 108 is attached to the main body 66 of the lock lever 54 through a cable aperture 110. In this regard, the cable 108 is fixably attached to the lock lever 54 and is operable to apply a force on the main body 66 of the lock lever 54 at the cable aperture 110 to rotate the lock lever 54 about the cross-member 52. In addition, a cable seat 112 is provided and is integrally formed with the upper housing 12, as best shown in FIG. 2A. The cable seat 112 serves to properly align the cable 108 with slot 46 of the extension 42, as best shown in FIG. 3. More particularly, the cable seat 112 fixedly receives a sleeve 111, whereby the sleeve 111 axially surrounds the cable 108 and is adapted to cooperate with the cable seat 112 to properly position the cable 108 relative to the lock lever 54.

[0038] A second cable 114 is fixably attached at a first end to an attachment aperture 115 formed in the flange 22 of the upper housing 12 and at a second end to one of the seat bottom 102 or recliner mechanism 106, as best

shown in FIGS. 1 and 7. In addition, a sleeve 117 axially surrounds the cable 114 and is operable to position the cable 114 relative to the upper housing 12. The sleeve 117 is fixedly attached to the lower housing 14 at a cable seat 119, such that the cable 114 is properly aligned with attachment aperture 115 of the upper housing, as best shown in FIG. 4.

[0039] The second cable 114 is operable to transmit a force to the upper housing 12 in response to movement of the seatback 104 relative to the seat bottom 102. As will be described further below, such movement of the seatback 104 relative to the seat bottom 102 will cause the second cable 114 to be placed under tension. Such forces cause the cable 114 to impart a force on the upper housing 112, thereby rotating the upper housing 12 relative to the lower housing 14 about the cross-member 52 in an effort to re-position the upper housing 12 in response to movement of the seatback 104.

[0040] With particular reference to FIGS. 4-8, the operation of the headrest assembly 10 and seat assembly 100 will be described in detail. When the seatback 104 is in a fully forward or upright position, the headrest assembly 10 is similarly in a fully upright position such that the main body 18 of the upper housing 12 is generally parallel to the main body 36 of the lower housing 14, as best shown in FIG. 4.

[0041] To recline the seatback 104 relative to the seat bottom, a force is applied to the recliner mechanism 106 at an actuation handle 116 such that the recliner mechanism 106 disengages the seatback 104. Once the recliner mechanism 106 has sufficiently disengaged the seatback 104, a force may be

applied to the seatback 104 to thereby rotate the seatback 104 relative to the seat bottom 102. The force applied to the recliner mechanism 106 via handle 116 causes a tensile force to be concurrently applied to the first cable 108, and thus, causes a force to be transmitted to the lock lever 54 via cable aperture 110.

[0042] Upon sufficient rotation of the recliner mechanism 106, the cable 108 will cause the lock lever 54 to rotate against the bias of spring 76. Sufficient rotation of the lock lever 54 in the counter clockwise direction (CCW), relative to the view shown in FIG. 4, will cause the main cylindrical body 86 of the lock spring 56 to unwind and disengage the outer diameter of the cross-member 52. In addition, such rotation of the lock lever 54 causes the stop 70 to disengage the lower housing 14 and permit rotation of the upper housing 12 about the cross-member 52. As previously discussed, once the circular main body 86 of the lock spring 56 disengages the outer diameter of the cross-member 52, the upper housing 12 is permitted to rotate relative to the lower housing 14.

[0043] Once the lock lever 54 has been rotated such that the circular main body 86 of the lock spring 56 disengages the outer diameter of the cross-member 52 of the lock assembly 16, the upper housing 12 may be relative to the lower housing 14. To rotate the upper housing 12 relative to the lower housing 14, a force applied generally to the upper housing 12 at flange 22. The force used to rotate the upper housing 12 is applied generally by the second cable 114. More particularly, because the cable 114 is fixed to the flange 22 of the upper housing 12 at a first end and fixed to one of the seat bottom 102 or recliner

mechanism 106 at a second end, rotation of the seatback 104 relative to the seat bottom 102 causes a tensile force to be applied to the cable 114. Such a tensile force 114 causes the upper housing 12 to rotate relative to the lower housing 14, as will be described further below.

[0044] The amount that the upper housing 12 rotates relative to the lower housing 14 is dictated by the relative rotation of the seatback 104 relative to the seat bottom 102. In other words, the farther the seatback 104 is rotated in the counterclockwise (CCW) direction relative to the view shown in FIG. 8, the farther the upper housing 12 is rotated in the clockwise direction (CW). Specifically, the farther the seatback 104 is rotated relative to the seat bottom 102, the farther the upper housing 12 will be rotated relative to the lower housing 14 due to the fact that the cable 114 has a fixed length and will not expand as the seatback 104 is rotated.

[0045] The cable 114 is a generally rigid member such that as the seatback 104 is caused to rotate rearward relative to the seat bottom 102, the cable 114 is not elongated. In this regard, the force associated with the reclining seatback 104 is adequately transmitted to the headrest assembly 10 such that the upper housing 12 rotates relative to the lower housing 14. The force is generated due to the relationship between the first end of the cable 114 (fixedly attached to the upper housing 12) and the second end of the cable 114 (fixedly attached to one of the seat bottom 102 or recliner mechanism 106). Once the seatback 104 rotates relative to the seat bottom 102, the first end of the cable 114 begins to rotate therewith. However, because the second end is fixedly

attached to one of the seat bottom 102 or recliner mechanism 106, the cable 114 experiences a tensile force. The tensile force is relieved once the lock lever 54 releases the lock spring 56, thereby allowing the upper housing 12 to rotate relative to the lower housing 14. As can be appreciated, such rotation of the upper housing 12 relative to the lower housing 14 adjusts the upper housing 12 relative to the seatback 104, and thus will maintain the headrest assembly 10 in close proximity to an occupant's head regardless of the position of the seatback 104 relative to the seat bottom 102.

[0046] Once the seatback 104 has been positioned in a desirable angle relative to the seat bottom 102, the recliner mechanism 106 is released and once again engages the seatback 104 to lock the seatback 104 in the desired position relative to the seat bottom 102. At this point, the cable 108 loses its tensile force due to the relationship of the recliner mechanism 106 and its return to engagement with the seatback 104. In this manner, the spring 76 once again biases the lock lever 54 in the clockwise (CW) direction relative to the view shown in FIG. 6. Once the spring 76 sufficiently rotates the lock lever 54 in the clockwise direction, the coiled body 86 of the lock spring 56 will once again engage the outer diameter of the cross-member 52 and lock spring 56 to the cross-member 52.

[0047] Once the lock spring 56 has sufficiently engaged the cross-member 52, the upper housing 12 is again restricted from rotating relative to the lower housing 14, as previously discussed. To return the seatback 104 to the upright position, a force is applied to handle 116 to disengage the recliner

mechanism 106 from the seatback 104. Once the recliner mechanism 106 has disengaged the seatback 104, the seatback 104 is free to rotate forward and into an upright position.

[0048] Once the seatback 104 is rotated forward relative to the seat bottom 102, the cable 108 will once again impart a tensile force on the lock lever 54 to thereby release the lock spring 56 from engagement with the cross-member 52. At this point, the upper housing 12 is once again able to rotate relative to the lower housing 14 about the cross-member 52 due to the interaction between the cable 108 and the recliner mechanism 106. However, because the seatback 104 is rotating forward relative to the seat bottom 102, the cable 114 does not impart a force on the flange 22 of the upper housing 12 as the cable 114 is not placed under tension. Rather, the cable 114 becomes slack, and thus, fails to direct the upper housing 12 to rotate in either the forward or rearward direction.

[0049] As can be appreciated, however, the relative position of the upper housing 12 relative to the lower housing 14 must still be maintained as the seatback 104 is rotated back to an upright position. The coil spring 62 serves to impart a rotational force on the upper housing 12 to rotate the upper housing 12 in the counterclockwise direction (CCW) relative to the view shown in FIG. 4 as the seatback 104 is rotated relative to the seat bottom 102 in the clockwise direction (CW). More particularly, when the lock spring 56 disengages the cross-member 52 (i.e. when the recliner mechanism 106 has released the lock lever 54 via cable 108), the coil spring 62 is permitted to rotate the upper housing 12 into

an upright position due to the interaction between the outwardly extending arm 94 and the post 96. In this regard, the upper housing 12 is able to maintain its relative position as the seatback 104 rotates either forward or rearward relative to the seat bottom.

[0050] The description of the invention is merely exemplary in nature and, thus, variations that do not depart from the gist of the invention are intended to be within the scope of the invention. Such variations are not to be regarded as a departure from the spirit and scope of the invention.